Mapping the public first-aid training landscape: uptake, knowledge, confidence and willingness to deliver first aid in disasters/emergencies– a scoping review

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Abstract

While the public can play a vital role in saving lives during emergencies, intervention is only effective if people have the skills, confidence and willingness to help. This review employed a five-stage framework to systematically analyse first aid and emergency helping literature from 22 countries (predominately in Europe, Australasia or US). 54 articles were included in the review and investigated public first-aid knowledge and uptake of first-aid training (40), public confidence in first-aid skills or willingness to help during an emergency (21); and barriers/enablers to learning first aid and/or delivering first aid in an emergency (25). Findings identifying high levels of perceived knowledge/confidence and willingness to help supports the contention that the public can play a vital role during an emergency. However, findings identifying low uptake levels, low tested skill-specific knowledge, along with barriers to learning first aid and helping suggest a first-aid training landscape in need of improvement.

Key Words: First-Aid Training; Emergency Helping; Lay Bystanders

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1. Introduction

Public knowledge of first aid (i.e. the skills and knowledge needed to provide medical assistance to a sick or injured person until full medical treatment is available)[i] is recognised as a valuable survival tool and key factor in reducing the number of avoidable deaths during emergency situations (McNulty, 2016, Penrose, 2009). The potential for active intervention from individuals with first-aid knowledge was highlighted in a British Red Cross study which found that up to 59% of deaths from injury during emergencies may have been prevented if first aid was given before the emergency services arrived (McNulty, 2016). However, while the public can play a vital role in saving lives during emergencies, public intervention is only effective if the public have the knowledge, confidence and willingness to help. Penrose (2009) emphasises the importance of this combination and found across three types of first-aid scenario (bleeding emergency, CPR and recovery position), only 7% of the population reported feeling *confident* in performing these types of first aid, *competent* with the correct knowledge and skills, and *willing to act* in an emergency.

Although several systematic reviews discuss the importance of training in improving first-aid skills (Van de Velde et al., 2009), little is known about levels of first-aid training and knowledge in the general population[ii], public confidence with their first-aid skills and willingness to helping in an emergency, and the different barriers and enablers for public uptake of first-aid training and delivery of first aid in an emergency. The aim of the current review is to address this gap to support the development of interventions that can enhance the provision of first aid during disasters and extreme events. Further, investigation of both confidence and barriers/facilitators to providing help in an emergency allows for an investigation of the factors

which affect pro-social helping behaviours. Indeed, while there is evidence of both low and high pro-social behaviour in emergencies (Drury and Cocking, 2007, Cox, 2012), it is not clear how this type of behaviour varies across type of emergency or first-aid skill required.

1.1 Research Questions and Search Methods

This review focuses on three important areas in the first-aid training and emergency helping literature: 1) public knowledge and uptake of first-aid training; 2) public confidence and willingness to help in an emergency; and 3) barriers and facilitators to attending first-aid training and helping in an emergency.

To investigate knowledge and uptake of first-aid training, the following initial research questions were asked:

1) What estimated proportion of the public have received first-aid training?
2) What level of knowledge do the public have of particular first-aid skills and first-aid advice?

To investigate confidence and willingness to help, the following initial research questions were asked:

1) What level of confidence does the public have in their first-aid skills?
2) How willing are members of the public to provide first aid during an emergency?
3) Does level of confidence differ for different first-aid skills/scenarios?
4) Does willingness to help differ for different first-aid skills/scenarios?

To investigate barriers and enablers of first-aid training and helping in an emergency, the following initial research questions were asked:

1) What barriers and enablers influence public uptake of first-aid training?
2) What barriers and enablers affect public willingness to help in an emergency?

3) Do barriers and enablers vary according to the type of emergency?

There are a variety of methods for reviewing research literature, but the most rigorous approaches are systematic or scoping reviews. As Arksey and O'Malley (2005) describe, a systematic review often has a well-defined research question, focuses on a particular type of research design and typically, assesses the quality of studies included. A scoping review is more appropriate for studying broader topics and when multiple research designs have been employed in the studies under review . In many cases, a systematic review with its protection against bias and quality assessment of sources can be preferable. However, for some reviews, the research question and research design under investigation may determine the choice.

For this review, the goal is not to answer a specific research question, but rather to provide a synthesis of the first-aid training and emergency helping literature; mapping out the barriers and facilitators affecting uptake of first-aid training and helping in an emergency. Consequently, a scoping review is more appropriate for this task. Similarly, a look at the topics of first aid training and emergency helping reveals that a range of research designs (including: interviews, focus groups and survey studies) are all appropriate for inclusion in this review. This again points to a scoping review as a more appropriate choice.

As a result given the breath of our research questions and plethora of research designs used in the literature -our investigation employed Arksey and O'Malley (2005)'s five-stage methodological framework for conducting scoping reviews, which involves: 1) identifying research question(s), 2) identifying relevant studies; 3) study selection, 4) charting the data; 5) collating, summarising and reporting the results. Where possible, we have also incorporated recommendations proposed by Levac et al. (2010). For example, in clarifying the research question and sample, balancing feasibility with breadth/comprehensiveness of scoping process, and using an iterative process to both study selection and data charting.

2. Methods

2.1 Identifying relevant sources

2.1.1 Search Terms

A range of search terms were used to cover the breath of concepts being investigated and use of different terminologies in journals and research fields (see Table 1). The databases searched were: MEDLINE, Web of Science (Core Collection), Scopus, HMIC, Psych Articles, Psych Info. Additionally, several grey literature sources were searched including ETHOS and Open Grey. Finally, we used a Google Scholar search with a stop limit set at 100 references (5 pages of 20 items) as a source for identifying both published and grey literature[iii]. This formal review process was supplemented with documents located via subject matter experts.

2.2 Study Selection

2.2.1 Inclusion/Exclusion Criteria

We discussed our target population in detail when deciding upon our final research questions. This follows the recommendations of Levac et al. (2010) who suggest that such discussions can help focus the scope of inquiry. In particular, we identified the public as our sample of interest. We define "the public" as people who are not employed as first aiders in the emergency services (see Table 1 for search term concepts and justifications). Secondly, we discussed the geographic scope of the review. Our primary aim was to understand the factors surrounding first-aid training. uptake and helping in an emergency in the UK. However, given limited UK-based research, and in order to capture as wide a range of potential barriers and facilitators as possible, we decided to broaden the scope of our inquiry to include papers from other contexts that are broadly compatible with the UK. Namely, countries that have – formal first-aid training programmes. Two inclusion/exclusion criteria were created from this

discussion. First, despite using search terms such as "public", "layperson", and "bystander", several papers studying only medical professional were identified during our search. These were excluded from the analysis. However, across all topics, five papers were included which had some form of professionals in their sample. These papers were not excluded because in each case the majority of their sample (over 85%) were non-professionals. Furthermore, several of these papers provided separate training statistics for the public. A second criterion rejected studies focussed exclusively on first aid in schools or the workplace because such training may not be representative of general first-aid training and/or skill level of the general public. Because of time and resource constraints only papers available in English and published between January 2000[iv] - November 2017 were included.

A further four exclusion criteria were added following a review of research abstracts. First, several cardiac arrest studies focussed on the use of automatic external defibrillators (AEDs). These devices add another factor, technology, to first-aid techniques, which may complicate barriers to learning or performing CPR. As our review was not designed to investigate the effect of technology and first-aid equipment is unlikely to be available to the public during disaster/emergency response, studies focussing solely on AED use (or where CPR and AED use were not analysed separately) were excluded. Second, other papers focussed on first-aid techniques falling outside the range of typical emergency first-aid skills, either because they were about psychological rather than physical first aid or had strong geographical specificity (e.g. snake bite first aid). Third, a sub-class of papers focussed on medical/clinical advice or regulations on the "best" way to perform first aid or logistical/economic issues of teaching first aid. As these papers did not discuss either public levels of first-aid knowledge, their willingness to help and/or barriers or enablers to helping, these studies were excluded. A final sub-class of papers focussed on the effects of specific types of training courses on levels of public knowledge (including skills retention) of first aid

and/or confidence in delivering first aid, which again falls beyond the scope of the current review.

2.2.2 Procedures

A1 (Author 1), A2 and A3 developed our literature search, which was conducted by A1. A1 and A2 independently reviewed abstracts against the inclusion criteria. There were very few discrepancies in assessment (<1%), which were resolved through discussion. Figure 1 presents a procedural flow diagram of the review process, including number of duplicates removed and number of cases removed at each stage of the review process.

3. Results

The findings of this review are presented separately for the three topic areas: 1) uptake and knowledge of first-aid training; 2) confidence with first-aid skills and willingness to help; and 3) barriers and enablers to first-aid training and emergency helping. Where a paper provides important findings for more than one topic, it is included in the discussion of/and in the summary tables of all relevant questions. For all studies, type of first aid considered, study location, design and demographics and sample size, plus training statistics have been recorded.

3.1 Uptake and knowledge of first aid

Of the 54 papers included in this review, 40 papers (74%) provided details about the proportion of the study's sample who had first-aid training or discussed the levels of knowledge that members of the public had about first-aid skills. These studies were conducted across North America, Europe, Australasia and Asia and included: 32 surveys, 5 interview/observational studies, 1 analysis of national training data and 2 first-aid test studies (See Appendix A).

3.1.1 Uptake

Of these, almost all (38 studies) reported the proportion of the participant sample trained in first aid at some point in their lives. Some also provided information about the recency of this training. Where possible we have classified references to training experience as follows: 1) proportion of sample who have had first-aid training at some point in their life; 2) the proportion trained less than 12 months ago; and 3) the proportion trained more than 5 years ago.

Table 2 shows that the proportion of the public (who participated in each study) who received first-aid training at some point in their life sits at approximately 50%. However, only 20% had undertaken this training within the last 12 months. Indeed, in many studies reporting recency information, over 50% of those trained reported that this training occurred more than 5 years ago.

Across studies, most participants fell into two categories: 1) those with a personal interest in learning first aid; or 2) those required to take or offered the opportunity to take a first-aid course at work. While Chair et al. (2014) reported a similar level of those trained for a job requirement (48%) as for personal interest (42%), most studies reported job requirement as the primary motivator (see for example: Chair et al.; 2000, Sipsma et al., 2011). The available demographic information suggests that first-aid training tends to be undertaken by those who are younger, male, and/or with higher levels of education (see for example: Anderson et al., 2014, Axelsson et al., 2006). This is reflected by the fact that students and the employed are more likely to have undertaken training than the unemployed or retired (see for example:, Donohoe et al., 2006, Kuramoto et al., 2008,).

3.1.2 Knowledge

Of the 40 out of 54 papers (74%) presented in Appendix A focussing on uptake of first-aid training and/or knowledge of first aid, 34 (85%) discussed the levels of knowledge that

members of the public had about first-aid skills, with the majority of studies focusing on participants' self-ratings of first-aid knowledge identifying a level of public perceived competence around 70% (see for exmaple:, Brooks et al., 2015, Jennings et al., 2009), with the exception of two sources where knowledge/competence was around 20-30% (Bakke et al., 2017, Son et al., 2017). This, 70% level of perceived competence may, however, be misleading, with people overestimating their knowledge. . Indeed, studies which also tested either public theoretical knowledge or practical first-aid skills demonstrate this clearly, with many finding generally low levels of first-aid knowledge or skills (see for example: Brooks et al., 2015, Celenza et al.). For example, less than 1% of Chair et al. (2014)'s sample answered all questions correctly when tested on their knowledge of CPR. Furthermore, even with a trained rate close to 100% (91%), Piepho et al. (2011) found not a single participant correctly followed the basic life support algorithm, with most performing the steps in a random order.

Overall these studies highlight that, for many basic first-aid skills, less than half of participants have the necessary first-aid knowledge and skills to help. This is especially true for CPR. For example, one study, which compared bleeding control and CPR identified a significant difference in skills-related knowledge (Penrose, 2009). In particular, while respondents had a good knowledge of bleeding control (87%) fewer had a good knowledge of CPR (21%). Furthermore, CPR knowledge is even lower when specific details such as correct compression-to-ventilation ratio, ventilation volume or compression depth during CPR are tested. Taking compression-ventilation ratio as an example, across most studies, the proportion of people able to give the correct ratio fell below 5% (see for example: Rajapakse et al., 2010, Rasmus and Czekajlo, 2000). Even for trained participants, the proportion is still only around 5% (Brooks et al., 2015). Moreover, Cheskes et al. (2016) found participants gave a range of 24 different responses when asked for the proper CPR ratio.

3.1.3 Summary

On its own, the percentage trained statistics is promising with 50% of the public trained to deliver first aid. However, once those trained more than 5 years ago (i.e. whose first-aid certificates have expired) are removed, the percentage drops below 25%. Knowledge levels follow a similar trajectory. While belief in one's skills is high (~70%), tested knowledge is lower, particularly for CPR-related knowledge/skills, where only 5% of trained individuals know the correct compression/ventilation ratio.

3.2 Public Confidence and Willingness to Help during an Emergency

In order for public intervention in an emergency to be effective, it is not only necessary for the public to be competent in administering first aid. They must also have confidence in these skills and a willingness to help. Of the 54 papers included in the review, 21 (38%) were identified which reported public level of confidence in their first aid skills and/or willingness to help in an emergency, most of which also discussed potential moderators. These papers described studies that were conducted across North America, Europe, Asia, and Australasia, including 18 surveys, 2 interview studies and 1 review (See Appendix B). Data extraction focused on (i) overall confidence level and/or confidence split by sub-skills; and (ii) overall willingness to help and/or willingness to help split by sub-skills. Any discussion of the interaction between these factors and key demographic factors were also identified and recorded.

Whilst confidence is associated with willingness, these are nonetheless independent concepts. It is not unfeasible, for example, that someone lacking confidence may be willing to give first aid a try, whereas someone confident in their skills may not be willing to help due to unrelated concerns, such as being in a hurry. However, many studies use these terms almost interchangeably. Where conflated, a figure of public confidence/willingness to help in an emergency of around 60% (range: 40%-74%) is identified (see for example: Ballesteros-Pena et al., 2016, Bray et al., 2017). A similar figure is also reported for confidence in studies which

tease apart these elements (see, for example: Donohoe et al., 2006, Lester et al., 2000,). However, when considered independently, willingness to help in an emergency is much higher at around 80-90% (see, for example: Donohoe et al., 2006, Lester et al., 2000).

Several factors including training level are identified as potential moderators of confidence and willingness to help. For example, Dwyer (2008) identified that those with training were almost three times as likely to feel confident to start CPR during an emergency (81%) compared to non-trained participants (30%). Further those with more first-aid training (either more recently or more frequently), those who are more highly educated, and/or male are more confident and more willing to help in an emergency (see for example: Donohoe et al., 2006, Dwyer, 2008). As with training, age and employment status were found to influence willingness to help in an emergency, with both a higher age and being unemployed associated with reduced helping (Kuramoto et al., 2008, Rasmus and Czekajlo, 2000). Finally, other studies highlight that type of CPR influences the level of willingness to help in an emergency, with lower willingness (~40%) for traditional CPR (which includes mouth-to-mouth ventilation) than chest-only CPR (~60%) (Cheskes et al., 2016, Lester et al., 2000). Investigating differences between different first aid skills, Penrose (2009) identifies that confidence (C) and willingness to help (W) appear lower for CPR (C=39%, W=68%) than for bleeding control first aid (C=60% W=78%).

3.2.1 Summary

There is some conflation in the literature between the concepts of confidence and willingness. Overall, however, these papers suggest that people tend to have very high perceived willingness to help in an emergency (~80% for most first-aid skills), but lower skills confidence (~60%). Note however that while the distinction between traditional CPR and chest-only CPR has been investigated (with the latter associated with higher willingness to help), with the exception of

Penrose (2009), few studies investigate differences in confidence with or willingness to perform different types of first-aid skills during disasters and emergencies.

3.3 Barriers and Enablers

Specific data extracted to investigate the research questions related to barriers and enablers of public delivery of first-aid during an emergency were: a list of barriers/enablers to learning first aid and a list of barriers/enablers to performing first aid. Any discussion of the interaction between these factors and key demographic factors were identified and recorded. Of the 54 papers included in the review 24 (44%) were identified which discussed barriers/enablers of first-aid training and/or helping in an emergency.

3.3.1 Barriers/enablers to uptake of first-aid training

Of these 24 papers, only 11 (46%) discussed the barriers/enablers for attending first-aid training. These papers presented studies conducted across North America, Europe and Asia, including 2 reviews, 7 surveys, 1 interview study and 1 focus group study (See Appendix C). The factors identified fall into three categories: informational, logistical, and emotional. Most studies included in this portion of the review focussed on CPR training.

Informational: Not considering first aid as an important skill and not realising how first-aid training (often CPR) saves lives (see for example:, Jennings et al., 2009, Sasson et al., 2013,) were common reasons the public gave for not attending first-aid training. For example, in an Irish survey, over 50% of respondents reported a lack of knowledge about the ability of first-aid training to save lives (Jennings et al., 2009). The public also reported a lack of publicity regarding the availability of nearby first-aid classes (Donohoe et al., 2006, Potts and Lynch, 2006, Sasson et al., 2013), and lack of access to resources for learning first aid (particularly for non-English speakers) as barriers to the uptake of first-aid training.

Logistical: Location and difficulties associated with finding a local first-aid course were variables mentioned alongside a lack of information on classes when respondents discussed reasons for not attending first-aid training (Donohoe et al., 2006, Potts and Lynch, 2006, Vaillancourt et al., 2008). Sasson et al. (2013) reported that cost was a particularly important issue for respondents from low income families. Specifically, respondents identified travel course and childcare costs as key barriers to learning first aid. Donohoe et al. (2006) identified similar financial concerns in research with younger respondents. Finally, the inconvenient timing of first-aid training courses and time commitment needed (see for example: Potts and Lynch, 2006, Vaillancourt et al., 2008) were also cited as barriers to the public uptake of first-aid training.

Emotional: Public fears about the safety of delivering first aid cut across both the willingness to learn and deliver first aid. For some, this was associated with worry about their physical capabilities or intellectual capacity to learn first-aid techniques such as CPR (Donohoe et al., 2006, Jennings et al., 2009, Potts and Lynch, 2006). Physical capability was a particular concern for older respondents (Potts and Lynch, 2006). For others, the fear that being trained would mean that they would have a responsibility to take action during an emergency was sufficient to dissuade them from undertaking this training, with a related worry that they could face legal consequences because of providing incorrect help (i.e. making a mistake) or even from failing to provide help (if trained) (Potts & Lynch, 2006, Sasson et al., 2013, Vaillancourt et al., 2008). Indeed, Sasson et al. (2013)'s North American respondents believed that a trained individual not providing first aid might be arrested for failing to help in an emergency. Additionally, Vaillancourt et al. (2008) found that fear of contracting disease (e.g. HIV) when administering first aid was sufficient to dissuade some people from undertaking training.

In summary, the barriers which limit uptake of first-aid training identified in this review were: 1) a failure to realise that first-aid skills can save lives; 2) a lack of available or convenient

first-aid classes or; 3) cost; 4) an aversion/fear of taking responsibility; and 5) a fear of infection.

Fewer studies focused specifically on enablers for first aid training, although for some, enablers were simply reported as the opposite to barriers. For example, some papers discussed how a failure to realise first aid can save a life decreases uptake of training (Potts & Lynch, 2006) while others discussed that a belief that first-aid skills can save a life increases uptake of training (Sasson et al., 2013, Vaillancourt et al., 2013). This was particularly true if people believed that they could save the life of a family member (Sasson et al., 2013). Similarly, for logistical issues, barriers relating to availability and convenience were described in relation to enablers such as having good advertising and the provision of nearby classes/training in the workplace (Jennings et al., 2009, Vaillancourt et al., 2013). For cost-related issues, some papers suggested that economic incentives (e.g. gifts for participation) or teaching courses free-of-charge would increase uptake of first-aid training (Donohoe et al., 2006, Sasson et al., 2013), especially for younger and low-income individuals. For students, this included making the training part of academic credit (Sasson et al., 2013). Few studies discussed enablers associated with emotional barriers (e.g. fear of responsibility and infection), except to mention that these should be discussed with participants in training sessions. Finally, future training was associated with prior training (Keim et al., 2001, Schmid et al., 2016) and having witnessed a cardiac arrest in the past (Schmid et al., 2016).

3.3.2 Barriers/enablers to performing first aid in an emergency

Of the 24 papers reviewed which discussed barriers and enablers, 21 (88%) of these discussed barriers and/or facilitators to performing first aid in an emergency. As with barriers to the uptake of first-aid training, these studies have been conducted across Europe, North America, South America, Australia, and South East Asia, including 4 interview studies, 12 survey

studies, 3 reviews and 2 discussion meetings (for surgeons) /focus groups (public) (See Appendix D). Although, most papers focussed on CPR skills, some investigated other first-aid skills (e.g. bleeding control emergencies; Jacobs et al., 2016, Jacobs et al., 2017) or discussed a wider range of first-aid skills (Penrose, 2009). The factors identified fall into four categories: 1) knowledge/beliefs; 2) competence and confidence; 3) situational features of emergency situations; 4) personal consequences of helping.

Knowledge/Beliefs: As for the decision to undertake training, individual beliefs about the effectiveness of first-aid was identified as an important factor in determining the likelihood of members of the public delivering first-aid during an emergency. For example, across several studies, believing that providing first-aid is vital to survival (Hansen et al., 2017) and having a wish to save a life (Axelsson et al., 2000a, Potts and Lynch, 2006) were associated with increased intentions to provide assistance in an emergency. Similarly, members of the public reported an increased intention to help if they believed that they could not cause any substantial harm, and, particularly in the case of CPR, that "*doing something is better than doing nothing*" (Hansen et al., 2017). These are important beliefs related to public willingness to deliver first-aid during an emergency, since many studies reported that fear of hurting the victim, making things worse, or performing a first-aid technique incorrectly were associated with reduced intention to help (see for example: Bouland et al., 2017, Chu et al., 2003). One study suggested that worry about doing something wrong was combined with an assumption that someone else more competent should help (Potts and Lynch, 2006), thus providing a potential explanation for reduced helping seen when other bystanders are present (Vaillancourt et al., 2008).

Overall, further hurting the victim by performing the techniques incorrectly was prevalent across the studies reviewed. According to Jacobs et al. (2016), this may be a particular concern for women and ethnic minorities. As for training uptake, encouraging beliefs about the importance of saving a life and teaching people that in many situations

(particularly CPR and cardiac arrests) they cannot make the victim worse is important to combat these fears and increase the likelihood that members of the public will deliver first aid during an emergency. Note, such teaching can only be effective if the guidelines surrounding what to do are clear. As Sasson et al. (2013) highlight, people often feel confused about performing CPR because of frequently changing guidelines (e.g., traditional CPR vs. chest-only CPR).

Competence and Confidence: Because of the factors above, it is unsurprising that studies cited a lack of confidence or competence in first aid skills as a barrier to helping (see for example: Mathiesen et al., 2017, Platz et al., 2000). Knowledge of first-aid techniques was identified as increasing skills confidence and reducing fear of hurting the person being assisted (Axelsson et al., 2000a, Mathiesen et al., 2017). Additionally, other studies suggested that teamwork (either with other bystanders or an emergency dispatcher) and the support provided by others is an important facilitator in boosting public confidence in their first-aid skills (Hansen et al., 2017, Moller et al., 2014).

Overall, having prior first-aid training is associated with higher skills confidence, which is associated with an increase in helping behaviour. Note however that while confidence tends to be associated with increased helping behaviour, it does not necessarily ensure help is provided (Vaillancourt et al., 2008). Other factors, including those discussed below may prevent even confident individuals from helping in an emergency.

Situational features of emergency situations: The literature reviewed identified several barriers relating to the disparity between training simulations and a real emergency (Mathiesen et al., 2017, Moller et al., 2014). In many cases, this related to the death of the person who required first aid. Seeing a dying victim led to feelings of helplessness/powerlessness (Axelsson, 2001, Axelsson et al., 2000a, Hansen et al., 2017, Mathiesen et al., 2017), and in

some cases, a sense of ambivalence (Axelsson et al., 2000a). These feelings led people to query whether their actions would actually help and to speculate on what the victim's life would be like if they survived (Axelsson et al., 2000a). Furthermore, the victim's appearance, including physical symptoms such as blood, vomit or jerking but also their expression of emotional symptoms (fear or panic) were also identified as barriers to helping (see for example: Jacobs et al., 2016, Johnston et al., 2003). For example, Hansen et al. (2017) identified repugnance as a key barrier to starting traditional CPR which includes mouth-to-mouth (MTM) ventilation. As other studies suggest, one way of reducing this barrier is to ensure access to a ventilation masks (Hansen et al., 2017, Johnston et al., 2003). Related to this and to issues of knowledge, other studies identified the uncertainty or ambiguity associated with a real emergency (see for example:, Moller et al., 2014, Vaillancourt et al., 2008) as a further barrier to helping.

Overall, in emergencies, the shock and discomfort of seeing a real patient may reduce public readiness to act, irrespective of an individual's training level (Donohoe et al., 2006, Hansen et al., 2017). Consequently, to increase the delivery of first aid by member of the public in emergencies, it has been suggested that training courses should discuss what a real emergency can be like, how people often react in such situations, and how this could affect their willingness to help (Axelsson et al., 2000a).

Personal Consequences of Helping: Barriers related to concerns about negative personal consequences associated with helping fall under three broad categories: 1) health/disease concerns; 2) personal safety concerns; and 3) fearing legal consequences.

Health/disease concerns were commonly linked with the physical symptoms and characteristics of the victim (e.g., blood, vomit) identified in the previous section. In particular, concern about risk of infection or disease associated with contact with bodily fluids (see for example: Axelsson, 2001, Bouland et al., 2017). For example, over 75% of respondents in a

survey of Australian adults (in households of patients presenting to the emergency department) believed performing mouth-to-mouth ventilation during CPR could transmit disease (Chu et al., 2003), despite the fact that risk of infection from CPR is low (Vaillancourt et al., 2008). Such fears were also found for performing other first-aid skills, such as controlling bleeding, where a fear of infection/disease was mentioned by 61% of respondents (Jacobs et al., 2016). This was the biggest barrier to helping identified in their shooting scenario (Jacobs et al., 2016). The literature reviewed suggests that concerns about infection are influenced by victim characteristics. Consequently, helping is lower when the victim is a stranger, when there are alcohol or drugs present or the person looks homeless, unkempt, dirty or poor (see for example:, Chu et al., 2003, Johnston et al., 2003). For example, Cheskes et al. (2016) report that for unkempt strangers, intention to initiate traditional CPR was lower with 40% of their sample citing a fear of infection during mouth-to-mouth ventilation compared with only 24% of those for a normal stranger.

Personal safety concerns were less commonly discussed but were also mentioned as factors which lead people to hesitate before helping (Jacobs et al., 2016, Mathiesen et al., 2017). For example, in a study of lay rescuers from real cardiac arrest emergencies in Norway, respondents mentioned that needing to feel safe was important before they would feel comfortable helping in an emergency (Mathiesen et al., 2017). They were therefore more likely to hesitate in unclear or unfamiliar environments. For Jacobs et al. (2016), one such personal safety concern was a fear of being in physical danger from additional violence and they found this was more common amongst women (50%) than men (36%) (Jacobs et al., 2016).

Overall, both unfamiliar environments and people can be seen as a danger to potential helpers, either through a perceived risk to their health (e.g. due to infection from contaminated blood) or to their safety (e.g., through the chance of violence). As a result, such factors will reduce the likelihood of a member of the public helping in an emergency.

Finally, intrinsically tied with a fear of doing something wrong or causing further injury, many studies highlighted a fear of legal consequences. When discussed as a barrier to training, this is usually because an individual may feel a "responsibility to act" if they have training and fear legal action if they choose not to help because they are worried about doing something wrong. For the actual delivery of first aid, this "responsibility to act" is not the issue. Rather, tied to the fear of doing something wrong is a concern that they would be seen as "responsible for a bad outcome" if it occurred. Thus, they may be blamed and subsequently sued because of it (see for example: Sasson et al., 2013, Schmid et al., 2016). Consistent, with a fear of being blamed, such fears are reported more often in scenarios involving strangers (Cheskes et al., 2016). Good Samaritan laws do exist which protect member of the public from the possibility of being sued. However, as Sasson et al. (2013) highlight people lack awareness of and/or misunderstand these laws. Including training on such laws in first-aid classes should therefore foster a belief that being sued is unlikely and thereby increase willingness to help during a disaster or emergency (Chen et al., 2017, Sasson et al., 2013).

3.3.3 Summary

The key barriers to helping in an emergency appear to be: 1) a fear of doing something wrong; 2) a lack of competence and confidence in first-aid skills; 3) dealing with situational features of emergency situations (e.g. uncertainty and sensory); and 4) fearing the personal consequences of helping, both health-related and legal. Several of these barriers are likely to be highly correlated. In particular, a lack of competence and confidence is likely to increase fear of doing something wrong and therefore harming the victim further. Such fears are then likely to increase aversion to taking responsibility for fear of being blamed.

In term of enablers to improve willingness to help, several papers included in this review suggested that making improvements to teaching first-aid so that fears and worries

concerning the emergency situation are discussed with trainees could be helpful. Furthermore, encouraging positive beliefs surrounding first aid (e.g., that providing first-aid is vital to survival and doing something is better than doing nothing) was also described as a useful way of increasing public willingness to help in an emergency.

4. Discussion

This review summarises three areas of research within the first-aid training and emergency helping literature: 1) public knowledge of and uptake of first-aid training; 2) public confidence in their first-aid skills and willingness to help in an emergency; and 3) barriers and facilitators to attending first-aid training and to helping in an emergency. This review found that whilst public willingness to help is high, both knowledge and uptake of first aid is low, particularly when uptake statistics are limited to only those trained within the last 5 years. Further, despite high perceived willingness to help in an emergency, there exist several consistent barriers to helping, which may influence actual helping rates in an emergency. These results suggest that first-aid training providers need to think about how to improve uptake of these courses as well as how to adapt courses to assist retention for difficult-to-learn skills and manage expectations about features of emergency situations that may be challenging for those tasked with giving first aid.

4.1 Learning First Aid

Of the countries included in the studies reviewed, taken at face value, the mean trained percentage of ~50% provides a promising view of the level of public first-aid training, as it has been suggested that to ensure help is always within reach, at least 30% of the population should know first aid (Serafin, 2010). However, over time without retraining or practice, memories of these skills fade (Altmann and Gray, 2002, Baddeley and Scott, 1971). Indeed, in several

studies discussed, either number of times trained (a measure of practice) or time since training was a significant predictor of first-aid performance measures.

Such concerns are reflected in first-aid certification recommendations, with the typical first-aid qualification remaining valid for just 3 years and annual refreshers advised (Canadian Red Cross, 2016, Health and Safety Executive, n.d.). Taking time since training into account, our review finds that ~50% of those trained have had their training more than 5 years ago (2 years longer than the recommended certification period). With an original mean trained proportion of 50%, perhaps a more accurate proportion of trained participants (i.e. those with valid, unexpired certification) may lie below 25% and those within the 1-year refresher recommendation sitting around 10% of the population. This adapted measure places the recommended population total holding current first-aid training certification far below the 30% recommendation (Serafin, 2010).

In increasing uptake rates, one option would be to make first aid a compulsory part of education and/or driver training certification courses. Since our review identified that past training is a significant predictor of attending future training, early exposure to training may increase the likelihood of continued, lifelong training. This is supported by evidence demonstrating that, in many countries with such types of training routes, the proportion of the population trained is high (Bakke et al., 2017). However, our review of the recency of training statistics suggests that a note of caution is needed. While many individuals may be trained in such countries, this does not ensure the training has been completed recently. Indeed, Piegho et al. (2011) reported a high rate of training (~90%), but most respondents had received this training more than 5 years ago. Compulsory initial training therefore does not necessarily ensure people will choose to undertake follow-up training.

When considering options for increasing the uptake of first-aid training, it is important to recognize some of the barriers to training that are identified by the public and identify ways to reduce these. As identified, there are both logistical/economical and mental barriers. Finding a nearby first-aid training course which fits into a person's schedule is often seen as difficult, with worries about both course costs and indirect costs (i.e. transport and childcare costs) further discouraging attendance. Such a barrier is, however, unsurprising given that traditional full training courses (e.g. those that provide first-aid certification) often take ~3 full days (British Red Cross, 2018). This time commitment might explain why people most commonly trained through the workplace, when it can become part of the working day. Without such allowance, courses blocked to take whole days may be difficult to accommodate into people's routines. Shorter sessions over a longer period of time; or mixtures between online and in person training may therefore represent ways of overcoming these issues, although currently e-learning or blended learning courses are not always accepted as valid forms of delivery (Health and Safety Executive, n.d.).

While it may be relatively easy to tackle these external barriers, the mental barrier (a fear of responsibility, which also limits helping in an emergency) may represent more of a challenge, particularly since it stems from a fear of doing something wrong. Indeed, even amongst those whose confidence in skills should be high, such as doctor and nurses, and for whom an emergency situation may even be considered "normal", there is evidence of this fear (Hull, 2014). The worry of being sued is also an issue for the public, despite good Samaritan laws to protect those who help in an emergency (e.g. SARAH Bill - 2015). These fears, in the public at least, are not surprising. Indeed, a brief informal search through two online first-aid resources (British Red Cross and St John Ambulance) did not reveal any clear and dedicated pages discussing these issues or the Samaritan Laws. Instead, such information tended to be accessible only by searching specifically for Samaritan Laws and often formed only a small

part of the articles they were mentioned in. One way therefore to reduce such fears may be in better integrating teaching of such laws into the first-aid training process or communicating these laws through mass media information campaigns. However, while such campaigns may alleviate these fears for many individuals, as the examples with medical professional highlight, it may not entirely mitigate these concerns.

As a final point, on should note that while increasing uptake of first-aid training will enhance the level of first-aid knowledge in the public, it may not necessarily ensure that all first-aid skills are accurately understood. While general skills may be remembered easily, many specific skills in CPR (such as the correct ventilation/compression ratio) can be difficult to recall.

4.2 Helping in an emergency

The fear of doing something wrong (and with it, the fear of responsibility) is a prevalent barrier not just to learning, but also to performing first aid in an emergency. As described above, it can even stop medical professionals from using their skills suggesting this fear is more complicated than a simple lack of confidence. Instead, another common theme discussed may shed light on why people may prefer not to "take responsibility" in these situations and why even, if perceived willingness to help is high (~80%), the true rate of helping may be much lower - that is the disparity seen between a first-aid training simulation and a real emergency situation. In particular, the uncertainty/ambiguity and the sensory landscape of the emergency situation (e.g. sights, sounds, smells).

First, it is important to be aware of the natural uncertainty/ambiguity associated with a real emergency. Simulations often test a single skill (or set of related skills), with a trainer close by to provide advice and feedback on what to do. In contrast, not only is there no trainer support, but emergency situations are rarely clear cut, with victims often suffering multiple

first-aid emergencies (e.g. they may be bleeding and not breathing properly). With little practice of triaging (i.e. assigning importance to injuries/patients), the public may revert to a "safe" choice: to ring the emergency services and/or wait for help.

Such a pattern of behaviour is consistent with theories of decision avoidance (Anderson, 2003). As this work suggests, when confronted with a difficult choice between multiple options, many people tend to choose either no action or no change. For a first-aid emergency, this may be equivalent to calling the emergency services and waiting for help. From a theoretical perspective, it is suggested that such choices may act as a type of protection mechanism reducing anticipated regret and blame. For example, Ritov and Baron (1990) have identified that for vaccinations, the regret a parent would feel if their child dies from a side effect of the vaccination was perceived as worse than the regret they felt if the child had died because they had not had the vaccine (i.e. the no choice condition). Applied to first aid, although ultimately harmful for the victim, choosing only to call emergency services may be a way of decreasing the perception of wrongdoing (i.e. the default action is seen as less blameworthy than acting wrongly) and reducing regret (i.e. feeling worse if perceived as "responsible" for a victim's death than as a passive witness). Unfortunately, increasing uncertainty and imposing a time limit, both common in first-aid situations, are known to strengthen these effects.

Second, it is not just the type of situation that differs, but also the sensory landscape (e.g. look, sound and smell) of a real emergency. As the discussion of barriers highlights, people are often unprepared for the sight of a real victim. This is not just physically, where participants can often be disturbed/repulsed by the sight of blood or vomit, but also emotionally, where not only are they affected by a victim's fears, but they may feel a sense of helplessness or powerlessness in the face of a dying victim. As Axelsson (2001) notes, it takes a lot of courage to overcome these fears during a real emergency.

Overall, while it is difficult to know who might be affected by these fears surrounding performing first aid in an emergency, some training schemes have begun to include discussion of the fears and worries surrounding an emergency situation (Oliver et al., 2014). This work suggests that the inclusion of these discussions can decrease fear of the emergency situations and increase propensity to act. Whether it changes actual helping behaviour is unclear.

5. Limitations

It is important to be aware of several important limits to this review. First, the willingness to help statistic placed at (~80%) might represent an overestimation of those who would help in an emergency. Indeed, with most included studies in this review asking this as a hypothetical question, these may give a sense of what people "wish" they would do, but not necessary what they will "actually" do. Further, these studies may also miss identifying potential enablers to helping in a mass casualty emergency, which do not exist outside of the emergency setting. Indeed, work by Drury and colleagues suggest that a shared experience of adversity can unite people during a mass-emergency situation (Drury and Cocking, 2007, Drury et al., 2009, Ntontis, 2016, Ntontis et al., 2018). These individuals, by perceiving themselves as sharing the same fate, may come to see themselves as sharing a common identity with other "victims" of the emergency. This "shared identity" has been associated with increases in pro-social actions in several cases including the London Bombings in 2005 (Drury et al., 2009) and York flooding in 2015 (Ntontis, 2016, Ntontis et al., 2018).

Second, our choice to focus on countries with first-aid training programmes that are comparable to the UK limits generalisations of these findings beyond these contexts. Furthermore, even within the geographic scope of this review, it is notable that more than half of the papers we reviewed presented European or North American data. This is likely a reflection of the English-language criterion, but nonetheless further limits the generalisation of

findings. The inclusion of multiple countries also means that we have reviewed data from a heterogenous sample in relation to both culture and experience. Given that there is evidence to suggest cross-cultural differences in group cooperation (Wagner,1995) we would ideally have conducted cross-national comparisons. However, there were not enough studies within each national context to allow meaningful comparison. The findings from this review are therefore not predictive but should be considered as indicative of the range of potential barriers and facilitators to first-aid training uptake and helping in emergencies.

Third, it is not clear in all papers how strictly they controlled the inclusion criteria in relation to distinguishing between members of the public with first aid training and first-aiders in the emergency services. We therefore cannot be certain of the level of experience of the people with first-aid training that were included in this review. Consequently, levels of perceived knowledge/confidence and willingness to help may be overstated in this review. However, findings identifying low uptake levels and low tested skill-specific knowledge suggest that this is unlikely to be the case.

Finally, although first-aid skills were searched broadly, most research focusses on CPR first aid. With many CPR courses do discuss other first-aid skills, it is reasonable to suggest that barriers to this specific type of training would often be similar to those seen for other first-aid training, however this may not always be the case. For example, disease transmission may be less worrisome for some first-aid techniques whereas other issues currently unknown may arise. Furthermore, specific features of the particular disaster/emergency may influence helping behaviour. For instance, with chemical contamination emergencies, where physical contact with an infected individual carries its own risks, barriers to performing first aid may be different. As this review highlights, several areas for future research exist, particular in investigating barriers and enablers for training and/or performing first aid skills such as burn, chemical, and even bleeding emergency first aid, which are less commonly discussed.

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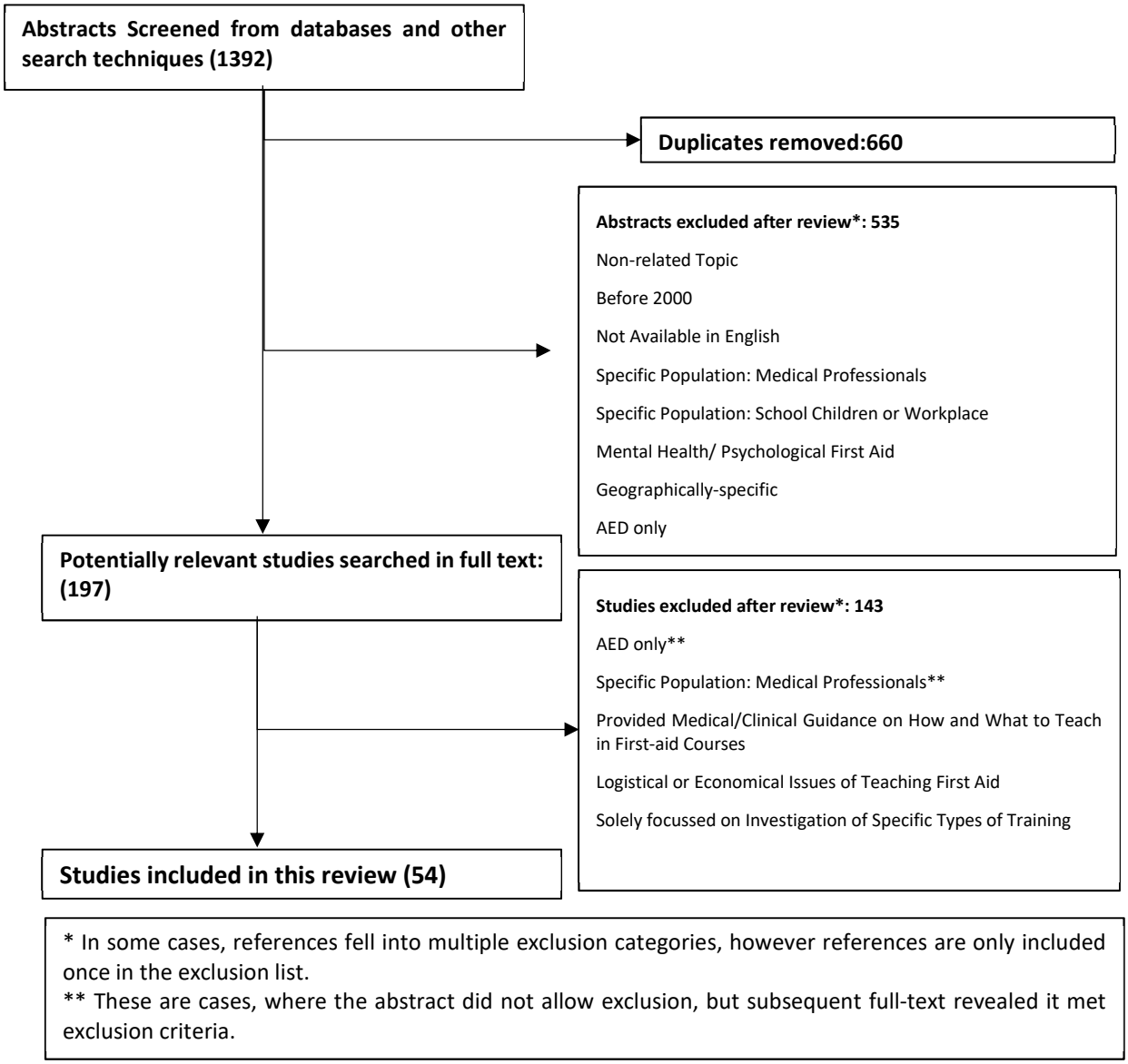
Mapping the public first-aid training landscape- A scoping review
Figures

Figure 1: Flow diagram of review process



* In some cases, references fell into multiple exclusion categories, however references are only included once in the exclusion list.
** These are cases, where the abstract did not allow exclusion, but subsequent full-text revealed it met exclusion criteria.

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Tables

Table 1: Search Term Concepts and Justifications

Concept	Description	Search Terms	Justification
Emergency First-aid Skills	Emergency first aid is the help given to a sick or injured person until full medical treatment is available.	First Aid (OR LSFA) Basic Life Support (OR BLS) Bleed* Control Cardiopulmonary Resuscitation (OR CPR) Recovery Position	Although the term first aid should feature and cover much of the literature, specific types of first-aid terms for the three major skills (CPR, Bleeding Control and Recovery position) were included to facilitate the inclusion of any skill-specific first-aid research. Other terms for emergency first aid including acronyms such as LSFA, and BLS (basic life support) were included.
Learning First Aid: Training and Skills		Training Skills	Different sources may focus and discuss either first-aid training (when discussing training rates) while others may focus more on skills (e.g. confidence in first-aid skills rather than first-aid training)
Type of Sample: Public/Lay bystanders	Members of the public not employed as first aiders in the emergency services. Professionals in the emergency services included: nurses, ambulance services, fire services, police and doctors.	Public Bystander Layperson	Depending on the domain used to study the effect as well as which question we are asking (e.g. uptake of training, confidence, willingness or barriers) different researchers uses a range of terms to denote non-professionals (i.e. not employed in the rescue or emergency services)
Type of outcome measures relevant to research question		Uptake Knowledge Appetite for Competence Confidence Evaluation Willingness to Help Helping behavio?r Barriers	Most were directly pulled from the key research questions identified in the previous section or were chosen as equivalent phrases. For example, competence was included as an equivalent phrase to knowledge.

Search tools: * : allowed multiple word endings (e.g. bleed, bleeding) ?: allowed multiple spellings (e.g. behaviour vs. behavior)
Where the database allowed it, search terms in the table above were combined in the following way: Search terms within concepts were combined using the 'OR' function, and concepts were combined using the 'AND' function.

Table 2: Training Uptake Statistics

Paper	% Ever Trained	% <12 Months	% >5 years	Paper	% Ever Trained	% <12 Months	% >5 years
Axelsson et al., 2006	45		33	Keim et al., 2001	48		
Axelsson et al., 2000b	47			Kuramoto et al., 2008	35		
Bakke et al., 2017	90		54	Larsen et al., 2004	74	12	
Ballesteros-Pena et al., 2016	37	29	46	Larsson et al., 2002	39		63
Barnhart, 2005	42			Ozbilgin et al., 2015	41		
Bouland et al., 2017	63	7	52	Penrose, 2009	68		
Bray et al., 2017	69	71		Piepho et al., 2011	91		
Brooks et al., 2015	61			Platz et al., 2000	49	7	
Celenza et al., 2002	64	20	42	Rajapakse et al., 2010	70		
Chair et al., 2014	21			Rasmus and Czekajlo, 2000	73		80
Chen et al., 2017	26			Sasaki et al., 2015	49	11	
Cheung et al., 2003	12	19	53	Schmid et al., 2016	36		28
Chu et al., 2003	40	22		Sipsma et al., 2011	79	17	
Clark et al., 2002	55	12		Smith et al., 2003	52	11	53
Coelho Rodrigues Dixe and Rodrigues Gomes, 2015	18		52	Swor et al., 2006	54		
Donohoe et al., 2006	30	13		Son et al., 2017	34		
Jacobs et al., 2016	47			Tomruk et al., 2007	42		
Jennings et al., 2009	28		77	Urban et al., 2013	66		
Kano et al., 2005	54		45	Woollard et al., 2004	36		
Mean	50	19	52	**Median**	48	13	52
Standard Deviation	19	17	15	**Range**	12-91	7-71	28-80

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Appendices (for Online Presentation Only)

Appendix A: Uptake and Knowledge of First-aid Training: Summary Table

Author	Location	Type of First Aid	Study Design & Sample Size	Relevant Sample Demographics (if reported)	Training Statistics: Ever Trained (<12 months; >5 years) %	Knowledge Level (self-rated/tested)	Demographic Interactions	Where trained? /Who By?
Anderson et al. 2014	US	CPR	National Statistics Analysis of CPR training data	N/A	Training level low: median training rate across counties (2.39%)		Lower CPR training associated with higher proportion of rural areas, black and Hispanic residents, lower income and higher age.	
Axelsson et al. 2000b	Sweden	CPR	survey of people trained in CPR (1012 respondents)	Female (57%) Mean age (36.9, SD: 12.8). Employed (78%) (up to 8% were self-employed) Students (16%) Retired (1%) Unemployed (4%) (less than 14% of all respondents were professional**)	47% had previous CPR training, which was 76% among professionals			Most had taken CPR course as a job requirement (35%).
Axelsson et al. 2006	Sweden	CPR	National Survey of 3167 respondents	Female (54%) Mean (SD) age: 46 (16) Employed (51%) & Self-employed (8%), Professionals (plus senior civil servants and executives** (10%). Students/military (7%), Pensioners or unemployed (24%)	45% trained (20% of these were professionals) Of these: <1 ½ years (23%), 5+ years (33%) 88% of the professionals were CPR trained.		Younger respondents, those living in rural areas, those born in Sweden, employees, students and military conscripts were trained more frequently in CPR. Very few of the 65+ group had attended a CPR training course.	

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Bakke et al. (2017)	Norway	CPR & BLS	Survey of 1000 respondents	Female (50%)	90% trained >5 years (54%) Median number of training sessions: 3 Median time since training: 4 years	*Self-rated:* Knew what to do in an emergency (72%) *Theoretical Knowledge (tested):* Poor overall knowledge level Training correlated with better theoretical knowledge, but not time since training.	Men and younger individuals were more likely to be first aid trained. Note: men were more likely to be involved with organisations where 100% of employers had first-aid training.	Work (52%) Non-government organisation (21%) Military service (16%) Driver's licence (13%) Club/organisation (6%) Occupational training (5%).
Ballesteros-Pena et al. (2016)	Spain	CPR	Survey of 605 individuals	Female (56%) Employed (62%) *(Any individual with medical nursing, healthcare or emergency care education or involved in the emergency medical transport service was excluded from the study)*	37% trained (28.6%, 46%)	Rated Competence: 20.2% considered themselves capable of performing CPR 74% claimed to know meaning of cardiac arrest, but only 45% felt they could identify it in an actual event	Younger individuals felt more competent at performing CPR. People with only elementary/primary (or no education) were three times more likely to feel unable to perform CPR techniques than the rest.	Trained By: Workplace (37%) emergency care (26.3%) Self-instructed (45%)
Barnhart (2005)	US	CPR	Telephone Survey of 1880 residents of New York	Female (60%) Mean age: 49.8 (SD: 17.5) ; 50+ (48%)	41.7% Trained (55% had not be recertified in over 2 years)		No sex or race/ethnicity differences in CPR training status. However, CPR training status by time, differences for sex and race are found. Women and whites had gone more than 2 years since CPR recertification than men and non-whites.	
Bouland et al. (2017)	US	CPR	Survey of laypersons attending CPR training. Survey before and after training: 238 respondents.	Mean age: 47.5 (14-81) Female: 57%	63% (6.9%; 52.2%)			

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Bray et al. (2017)	Australia	CPR	Survey of 404 respondents 55% lived in regions low in BCPR (Bystander CPR)	N/A	High BCPR area: 62% Low BCPR area: 75% Overall: 69% (71%; N/A)			
Brooks et al. (2015)	UK	CPR	Survey of 1004 respondents	N/A	61% trained	Self-rated Response: Knew what to do in the case of a cardiac arrest (79%). Looking at self-reported actions for trained/not trained: Shout for help (41%, 22%), call 999 (66%, 61%), check response (50%, 21%), check breathing (58%, 21%), commence CPR (55.0%/ 20%), correct compression rate (5%, 2%), correct compression/breath ratio (7%, 1%).		Where/who trained: Non-healthcare work (50.9%) School/college/extra-curricular (21%) Healthcare work (13%) Charities (St John Ambulance/Red Cross) (10.6%) Military (3%) Doctor (1%)
Celenza et al. (2002)	Australia	CPR	Telephone survey of 803 respondents An urban sub-sample performed a practical demonstration of CPR using manikins	N/A	64% trained (20%; 42%) Trained times: 1 (38%) 1-5 (38%) 5+ (16%),	Those with theoretical knowledge did do better in the practical session, but this relationship was poor for some tasks. For example, in determining consciousness questions, 70% of those correct in the theoretical performed correct in the practical test). However, for determining circulation (e.g. if person had a pulse) only 34% of those correct in theoretical test got this correct in the practical test.	Practical and theoretical assessment scores higher in trained versus untrained participants Number of times trained in CPR was more effective for retention and competence than time since last training. No gender differences in theoretical knowledge. Degree of training and theoretical competence were lower in those aged 65+ (particularly if retired). Differences were not found in practical performance.	

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Chair et al. (2014)	Japan		Telephone Survey of 1013 respondents	Female (57%) <50 years (61%) Employed (50%)	21% trained	Overall CPR knowledge low. Only 0.4% answered all questions correctly. This represented 1.9% of those who received CPR training.	Being employed and higher education were associated with CPR training. Trained respondents more likely to get higher knowledge and correct responses.	St John Ambulance (49%) Red Cross (14%) Workplace (16%) 48% of training was conducted as part of a job requirement 42% as personal interest
Chen et al. (2017)	China		Questionnaire survey of 1841 respondents	Female (50.8%)	25.6% trained	90.1% understood what CPR is. Among trained, 51% knew the standard CPR procedure and believed they had the ability to perform CPR. 49% knew the procedure but did not believe they had the ability to perform CPR on victims.		
Cheskes et al. (2016)	Canada	CPR (Chest Only vs. Traditional)	Survey of 428 respondents	Female (50%)	N/A	93.5% had heard of CPR However, when asked to list steps, mentioned: ABC (38%), Chest compressions and rescue breaths (22%), Chest only CPR (14%). 24 different compression-ventilation rates reported.	N/A	N/A

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Cheung et al. (2003)	Japan		Telephone interview using a structured multiple-choice questionnaire of 357 respondents	Females (59%) <45 years (71%)	12% CPR trained (19%; 53%)	44% of respondents knew how to determine whether a person is unresponsive and needs help; 77% knew they should call for help. Less knowledge about securing airways (25% correct and said this was top priority and 32% gave correct method of opening airways). 31% knew correct procedure for starting rescue breathing. 45 knew carotid area is best location to check for a pulse. 6% said they would start external chest compression if no pulse and 26% knew where the hands should be placed during CPR. Only 1 in 42 of the trained participants correctly answered all questions.	Men were more likely than women to have undergone CPR training. Education was correlated with prior CPR training with half of those trained were university graduates. Knowledge scores were higher for younger respondents and those with a higher education. Prior training was associated with better scores, with scores decreasing the longer that time elapsed since training (especially in first three years and after more than a decade).	Where trained: St John's Ambulance (57%), Red Cross (5%), Auxiliary Medical services (2%) Why taken course: Personal Interest (57%) Nature of work (31%) Organisational (10%)
Chu et al. (2003)	Australia		Survey on CPR ability, barriers/facilitators for those presenting to hospital with or without chest pain or IHD and their household. Sample size: 558 respondents	N/A	~40% (22%; up to 57%)			

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Clark et al. (2002)	Australia	CPR	Survey of 4490 respondents	Female (46%) Age: <40 (39%); 40+ (61%) Employed (62%), Student (2.5%)	55.2% (12.1; N/A) trained	65.2% said they knew how to do CPR	Males and those with higher education are more likely to be CPR trained. Students and those employed were more likely to have CPR skills. Older individuals (>40) and those with poor education are less likely to be trained.	
Coelho Rodrigues Dixe & Rodrigues Gomes (2015)	Portugal	General	Observational Study, including 1,700 who responded to questionnaire	Female (56%) Employed (93%) Students (5.0%) Retired or unemployed (2%)	17.8% trained in BLS	Tested Knowledge: Low levels of BLS knowledge (correct answers in 25.9 ± 11.5 of the 64 questions). Knowledge of chest compressions and casualty placement (in breathing non-trauma cases) was low (50% correct).		Trained by: Red Cross (23.5%), Qualified training centre (21.8%), HE/University (16.7%), firefighters (16.4%)
Donohoe et al. (2006)	UK	CPR	Interviews conducted on 1011 respondents	Female (52%) Age: <45 (57%), 45+ (43%) Employed (56%), retired/homemaker/carer (27%)	30% trained (13%, >45%) 56% of those trained had never attended a refreshers training session.	Only 31% of those who knew the term knew it was an abbreviation and what it stood for. 54% however could define CPR accurately as mouth-to-mouth resuscitation plus chest compressions (12% just defined it as chest compressions). 18% of those who knew the term didn't know what it entailed.	Those aged between in the middle age groups (25-59) were more likely to have received training as were those employed. 57% had heard of CPR. Those aged between 25-44 were more likely to have heard of the term (70%) compared to those >60 (25%) Recognition greatest in those trained (84%) compared to not trained (45%).	

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Jacobs et al. (2016)	US	Bleeding Control	Survey interviews were conducted with 1,051 respondents.		47% trained in first aid (however only, 72% of these courses included severe bleeding) 13% had first-aid training in the past 2 years. 52% had their training more than 5 years ago.		The highest percentage trained were the 50-64 years old, and lowest for the 18-29-year-old group.	
Jennings et al. (2009)	Ireland	CPR	Cross-sectional survey of 974 respondents	Female (51%) Age: <45 (58%), 45+ (42%) (Note: 8% health care professionals and a further 4% in non-healthcare uniformed positions, e.g. police)	28% trained (N/A, 77%)	70% said they would have no difficulty in giving CPR.	Lower social class and older individuals were less likely to be trained.	Workplace major source of awareness and training (49.3%), followed by friend/colleague (15.7%), school/college (12.2%) and sports and leisure environment (1.8%) 64.8% required to train for work.

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Kano et al. (2005)	US	General	Telephone interview survey (conducted both after earthquake in 1994 and El Nino in 1998. 414 respondents	Females (55%) Age: <40 (43%) Employed (65%)	53.9% trained (N/A; 45%) Type of training: Basic first aid online (45%), Basic CPR only (25.1%), Basic first aid and CPR (39%), advanced first aid and CPR (8.5%)		Being <40, education beyond high school were associated with higher likelihood of getting first aid trained	Trained by: Red Cross (32%), School (13%) Employer (11.7%), Hospital (13.0%), fire/police (9.4%) Military (4.5%) Youth organisation (3.1%) Paramedic training (0.9%)
Keim et al. (2001)	US	CPR	Postal Survey of 947 respondents	Female (53%) Mean age (69 (48-88) *Sampled older age group in gated community where CPR classes are organised frequently (3 times a month)*	48% trained 84% not currently certified.		Increasing age was associated with a lower desire to become certified in CPR. Those previously certified in the past were more likely to want to be CPR-certified than those who didn't.	
Kuramoto et al. (2008)	Japanese	CPR	Questionnaire survey of 1132 respondents	Female (53%) <40 years (68%) Employed (not including self-employed) (47%), Students (6%) unemployed (31%)	35% trained 50% trained once, 30% twice and 20% > 3 times.		Those trained in CPR were independently associated with younger age, office workers or skills workers and having a driver's licence.	
Larsen et al. (2004)	New Zealand	CPR	Telephone survey of 400 respondents.	Female (59%) Age: <45 (55%); 45+ (45%)	74% trained (12%; 63%)	CPR knowledge poor. Only 4% knew correct compression-to-ventilation ratio for adult CPR.	Older subjects were less likely to have learnt CPR than younger subjects. Knowledge highest for those taught more recently (<12 months) and aged between 26-45.	

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Larsson et al. (2002)	Sweden	General	Questionnaire of 1,907 respondents	Female (44%) Age: <45 (47%);	39% trained		Training rates higher for those younger and with a higher education. These participants are also more likely to want to attend a training session. More women than men had received first-aid training through employers or schools and Red Cross, but not for the armed forces. Younger participants most commonly trained by schools, followed by armed forces. 1/3 of those in oldest category were trained by the Red Cross.	Training by: Employers (48%), Military (17%), Schools (16%) Red Cross (12%) Police/medical or rescue services (6%) Driving school (1%)
Ozbilgin et al. (2015)	Turkey	CPR	Questionnaire survey of 533 respondents	Employed (49%), unemployed (1.1%), retried (8.3%), students (10.1%)	40.7% had received CPR training	Signs of Cardiac Arrest mentioned: loss of consciousness (41%), cessation of breathing (50%), cessation of circulation (61%). Only 36% could perform chest compressions, 27.6% could perform MTM and 28.7% could do both. Only 1.5% knew three of the cardiac arrest signs in the list and 4.5% two of them. Rate of those who knew how to perform cardiac massage was 42%.	Knowledge was higher for those who had received training.	Workplace (8.4%) Driving School (7.3%)

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Penrose (2009)	UK	General	National Survey on CPR Recovery position and bleeding control skills conducted, and results summarised by British Red Cross Sample size: Unknown	N/A	68% trained	Competence/knowledge: Recovery position (59%), Bleeding control (87%), CPR (21%)		
Piepho et al. (2011)	German	General	Practical first-aid test.	Female 47% Median Age: 44 (18-81) *Medical Professional were excluded**	91% had attended training (N/A; up to75%)	Tested knowledge/skills: No participant followed current BLS algorithm correctly. Most steps were performed in random order. Skills performed: responsiveness check (43%), chest compressions (64%), rescue breaths (63%) or shout for help (0%)	Less knowledge (and failure to provide chest compression and rescue breaths) was higher in those who attended a BLS course more than 11 years ago. Rescue breaths were performed more often by men. Younger individuals (18-45) were more likely to open airways and perform rescue breaths.	32% trained because prerequisite for driver's licence.
Platz et al. (2000)	US	CPR	Cross-sectional survey of 100 family members of cardiac patients	Female (71%) Age: <50 (32%), 50+ (68%)	49% (7%; N/A)		Age, gender and race and education were not significant predictors of CPR training.	Trained For: School or Job requirement (59%).

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Rajapkse et al. (2010)	Slovenia	CPR	Telephone Survey of 500 participants	Female (48%) Age range: 18-86	70% (N/A; 80%)	Knowledge of skills poor. Knew that: CPR includes rescue breathing (47%) and chest compressions (45%). Knew rate of chest compressions (1.2%), compression-to-ventilation ratio (2.2%) and knew both (0.6%)	Subjects with training knew about rescue breaths and chest compressions twice as often (including correct strength and site). They were also more likely to recognise a cardiac arrest (56.5% vs. 37.9%) and listed more symptoms and were more likely to list all 3 signs (unconsciousness, breath and circulation) than non-trained individuals. Compared to those untrained, those listing no knowledge of symptoms was low (27% vs. 45%). Older subjects are less likely to be CPR trained. Training made a difference to people listing of the procedures in BLS. Similar to symptoms, trained individuals were less likely to report no knowledge (35 vs. 70%). Similarly, knowledge was higher in those with more recent training (<6 years ago), including for knowledge of frequency of chest compressions, compression-ventilation ratio and strength of chest compressions.	
Rasmus & Czekailo (2000)	Poland	CPR	National Survey of 1092 respondents	Female (52%) Age: <40 (48%); 40+ (52%) Occupation: employed (48%), housewife/retirees/unemployed (41.46%); students (9.4%)	73% trained (31% more than once)	Only 3% of all respondents had correct knowledge of the compression-to-ventilation ratio.	Knowledge test: Women showed lower CPR knowledge responses than men (52% vs. 47%). Older individuals scored lower than younger individuals. People living in cities scored higher as did those with a higher level of formal education. Those who were farmers, housewives and retirees, plus unemployed score lower than the average. Men were twice as likely as women to have received BLS training. Those 60+, individuals with lower education, housewives and retirees were less likely to be trained.	

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Sasaki et al. (2015)	Japan	CPR	Online survey of 4,853 respondents	Female (54%) <40 years (46%) Employed (70.8%)	49% CPR trained (11%;28%)			
Schmid et al. (2016)	Costa Rica	CPR	Survey of 370 respondents	Female (40%) >40 years (77%)	36% trained	70% knew correct CPR steps	Future training was associated with prior training and having witnessed a cardiac arrest previously.	
Sipsma et al. (2011)	US	CPR	Telephone survey of 1001 respondents.	Female (61%) Age: <40 (16%)	79% trained (17.4%; 53%) For those 60+ 73.4% trained. 66.4% had attended their most recent class >5 years ago.	72% said they knew how to perform CPR	Those not trained were: older, men and less likely to have at least a 2-year college degree.	52% trained because it was required, 23% because it was available in their workplace or neighbourhood
Smith et al. (2003)	Australia	General (focus: CPR)	Telephone survey of 1389 respondents	N/A	52% trained (11%; N/A)	86% said they knew what CPR involved. However, when asked to describe it, only 65% correctly described CPR as pushing on the chest and breathing into the mouth.	Those younger than 56, with training in a trade, tertiary education were more likely to be CPR trained.	
Son et al. (2017)	Korea		Interview/questionnaire survey of 1000 respondents	Female (52%) <40 years (38%)	36% (27%; 31%)	Know what CPR is (89%) and how to perform it (35%).		
Swor et al. (2006)	US	CPR	Telephone interview (of callers to 911) during OHCA. Sample size: 684 interviews		54% trained			

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Tomruk et al. (2007)	Turkey		Questionnaire of 318 bystanders	34.3% (63% group received first aid during driver's licence course)		Knowledge: No knowledge question was answered correctly by more than 75% of individuals (excluding explaining first aid provided for a fall patient). The lowest rates of knowledge were found for the bleeding control (16% correct) and ratio of CPR ventilation to chest compressions (16%).	Aged <44 years old, above primary school education, healthcare personnel, experience with emergency first aid (and times encountered situations requiring first aid), having taken a first-aid course, recency of training (<12 months), whether course was conducted as part of a driving test (lower scores) vs. other courses, having a valid first-aid certificate or driving licence were associated with a higher knowledge level.	
Urban et al. (2013)	US	CPR	Survey of 532 respondents	Female 53% Mean age: 44 (±16)	42% trained	23% had knowledge of Hands-only CPR. 67% confident in recognising the signs of someone suffering a heart attack. Only 6% knew the correct frequency for chest compressions.	Age and income predicted levels of CPR knowledge.	

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Woollard et al. (2003)	UK	General/CPR	Test of training immediately and 6 months later Sample size: 112 (76- 6 months later)	Female (38%) in both initial and finished group and mean age of 35 (19-65)	Including those who dropped before post-test (66% had completed some form of prior first aid before this course. (Note: 44% of these were firefighters who took first-aid classes regularly)	All skills improved after training (biggest increase in correct performing of initial checks (responsiveness, breath and circulation); lowest for CPR specific skills, rescue breaths, ventilation volume and compression rate and depth, except compression-breath ratio or sequence of actions. After a delay, initial checks were performed less well as were compression-breath ratio and sequence of actions. No significant difference in other behaviours (however, these are the same behaviours which did not show big increases after initial training) Subsequent refresher training did improve most skills (but not significantly for ventilation volume, compression depth and initial circulation checks). Even after refresher: Participants were incorrect for a number of skills: Incorrect airways check (25%), incorrect circulation check (76%), failed to ventilate at correct volume (65%), incorrect hand position for compressions (33%) or incorrect compression depth (38%) Only 11% gave correct compression rate.		

Appendix B: Confidence and Willingness-to-help: Summary Table

Authors	Location	Type of First Aid	Study Design & Sample Size	Relevant Sample Demographics (if reported)	Ever Trained (<12 months; >5 years) %	Confidence & Willingness to help	Interaction with Individual Differences Variables (of respondent)
Ballesteros-Pena et al. (2016)	Spain	CPR	Survey of 605 individuals	Female (56%) Employed (62%) *(Any individual with medical nursing, healthcare or emergency care education or involved in the emergency medical transport service was excluded from the study)*		Willing to perform CPR: No MTM (58%), MTM (45%).	
Bouland et al. (2017)	US		Survey of laypersons attending CPR training. Survey before and after training: 238 respondents.	Mean age: 47.5 (14-81) Female: 57%	63% (6.9%; 52.2%)	Pre-training confidence; 4/10; Pre-training Willingness to help (family): 9/10; Pre-training willingness to help (stranger): 5/10. Previous training did not significantly change these.	
Bray et al., (2017)	Australia	CPR	Survey of 404 respondents 55% lived in regions low in BCPR (Bystander CPR)	N/A	High BCPR area: 62% Low BCPR area: 75% Overall: 69% (71%; N/A)	Confidence Level: Similar across areas: 62% (H BCPR); 66% (L BCPR) No difference in reasons for why willing/ not willing to perform CPR.	No Significant differences between areas of L and H BCPR regions. Type of victim not a significant predictor of willingness to help for either traditional CPR or hands only CPR.
Chu et al. (2003)	Australia	CPR	Survey of those presenting to hospital with or without chest pain or IHD and their household. Sample size: 558 respondents	N/A	~40% (22%; up to 57%)	66% confident they could perform CPR.	

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Authors	Location	Type of First Aid	Study Design & Sample Size	Relevant Sample Demographics (if reported)	Ever Trained (<12 months; >5 years) %	Confidence & Willingness to help	Interaction with Individual Differences Variables (of respondent)
Cheskes et al. (2016)	Canada	CPR (traditional vs. chest-only	Survey of 428 respondents	Female (50%)		When victim unknown, willing to provide CPR was higher when MTM was excluded than when included (61% vs. 40%).	Among those not willing to do traditional CPR, women were more likely to indicate willing to do CPR when MTM not present .
Donohoe et al. (2006)	UK	CPR	Interviews with 1011 respondents	Female (52%) Age: <45 (57%), 45+ (43%) Employed (56%), retired/homemaker/carer (27%)	30% trained (13%, >45%) .	61% of those trained in CPR said they would feel confidence in performing CPR in an emergency. Across all participants, willingness to perform CPR was 79% for traditional CPR and 87% for chest compression only CPR.	Those trained were 3x as likely to consider starting chest compression than those not trained: 40% vs.14%. Also, twice as likely to consider performing mouth to mouth resuscitation (54% vs. 21%). Older individual more likely to call the hospital. (62% vs. 52%). White respondents were less likely to select this action than those other ethnic groups (52% vs. 64%).
Dwyer, (2008)	Australia	CPR	Interview (telephone) with 1208 respondents	Female (50%). Age: <45 (45%), 45+ (55%)	74%	Confident to start CPR (68%) on a relative. Taken split by training, 81% for trained vs. 30% not trained. Confident individuals were more likely to express either concern of fear of failing (37%) or no concerns about initiating CPR (30%). For not confident individuals, performing CPR correctly was the greatest concern (55.4%)	Most Confident: Men, those with training, more than 11 years of education. People who had previous witnessed a successful resuscitation of a family member were more confident to start CPR.
Johnston et al. (2003)	Australia	CPR	Survey of 4480 respondents	N/A	N/A	55% of respondents reported they were "extremely" likely to perform CPR, with 30% "somewhat" likely. Less than 0.5% said they would perform either chest compressions or MTM ventilation only.	

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Kuramoto et al. (2008)	Japan	CPR	Questionnaire survey of 1132 participants	Female (53%) <40 years (68%) Employed (not self-employed) (47%) Students (6%), unemployed (31%)	35% trained	Willing to attempt CPR for family and friends (13%) and for stranger (7%)	Willingness was associated with being an office or skilled worker, having trained in CPR, actual experience with CPR and having friends with heart disease.
Larsen et al. (2004)	New Zealand	CPR	Telephone survey of 400 respondents.	Female (59%) Age: <45 (55%); 45+ (45%)	74% trained (12%; 63%)	63% willing to perform mouth-to-mouth ventilation on a stranger.	
Lester et al. (2000)	UK	CPR	Survey of 800 lay CPR trainees (~ 4 years after training)	N/A	100% (21% had retrained in CPR since their original course)	Retrained individuals were more confident than those no retrained. Confident to attempt CPR: re-trained (90%) vs. not retrained (48%). Willingness to help: 80% said they would perform CPR on a stranger, but this feel to ~40% when either: facial blood was present or victim gay. *Authors suggest that this statistic is driven by a fear of infection from victim rather than a prejudice.*	
Nielsen et al. (2013)	Danish Island	CPR/ General	Telephone survey (conducted before (812 respondents) and after (815 respondents) TV campaign to increase training) The local television station presented broadcasts about resuscitation, including interview with bystanders and how to sign up for the courses.	N/A	After intervention: 75% participated in first-aid course.	TV campaign increased the number confident to provide chest compressions and MTM. Those who had training in past 5 years had higher willingness to perform BLS and MTM.	

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Authors	Location	Type of First Aid	Study Design & Sample Size	Relevant Sample Demographics (if reported)	Ever Trained (<12 months; >5 years) %	Confidence & Willingness to help	Interaction with Individual Differences Variables (of respondent)
Ozbilgin et al. (2015)	Turkey	CPR	Questionnaire survey of 533 respondents.		41% trained	To whom would you apply CPR without hesitation: 96% (Neighbour) 90.6% (Family) 77% (Friend) 42.5% (Stranger)	
Penrose (2009)	UK	General	National Survey on CPR, recovery position and bleeding control skills conducted, and results summarised, by British Red Cross Sample size: Unknown	N/A	65% trained.	Recovery Position: Confidence (59%); Willingness to help (78-89%); Bleeding: Confidence (60%), willingness to help (89%) CPR: Confidence (39%). Willingness to help (68-80%) *Lower percentages in range denote the scores for willingness to help a stranger, while higher number denotes willingness to help a known individual.*	Males were slightly more likely to be confident and willing to act. Time since last training largest discrimination of confidence, competence and willingness to act. Those with knowledge of bystander effect were more likely to be confident and willing to act.
Potts & Lynch (2006)	N/A	CPR (Confirm)	Review	N/A	N/A	Knowledge of CPR did not affect willingness to help. Those more willing to help focus on positives of performing CPR (e.g. saving a life) while those less likely to help focus on negative aspects of performing CPR (e.g. infection from victim).	
Rasmus & Czekajlo (2000)	Poland	CPR	National Survey of 1092 respondents	Female (52%) Age: <40 (48%); 40+ (52%) Occupation: Employed (48%), housewife/retirees/unemployed (41.46%); Students (9.4%)	73% trained (31% more than once)	Confidence: 59% evaluated their ability to perform CPR as inadequate. Willingness: 90% willing to provide first aid	Women and 60+ were more likely to feel less competent. 60+ and with only elementary education, not in employment (e.g. housewives and retirees) were less willing to help.

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Authors	Location	Type of First Aid	Study Design & Sample Size	Relevant Sample Demographics (if reported)	Ever Trained (<12 months; >5 years) %	Confidence & Willingness to help	Interaction with Individual Differences Variables (of respondent)
Schmid et al. (2016)	Costa Rica	CPR	Survey of 370 participants	Female (40%), >40 year (77%)	36% trained	Willingness: 74% Higher willingness to perform CPR if victim family member, followed by child stranger or geriatric stranger (all <70%), but lower for those seen as indigent (poor-55%).	
Sipsma et al. (2011)	US	CPR	Telephone survey of 1001 respondents.	Female (61%) Age: <40 (16%)	79% trained (17.4%; 53%)	40% confident in their ability to perform CPR in an emergency. Confidence (out of 10) highest for those trained (6.1) vs. not trained (3). For those not confident, similar amount (33%) gave never been trained or trained long ago as a reason for this lack of confidence. Other reasons: not comfortable, not physically able or never done it before.	For trained: Younger, male, trained in the past 5 years, trained 3 or more times were more confident/willing to perform CPR. None of these were associated with willingness in those not trained.
Smith et al. (2003)	Australia	General (focus: CPR)	Telephone survey of 1389 respondents	N/A	52% trained (11%; N/A)	55% felt confident about their CPR skills. Willingness to help in cardiac arrest scenario: Call EMS (69%); get/call for help (28%); chest compressions (51%), give MTM (61%); DRABC (17%), roll onto side (11.4%), cover/make comfortable (5.7%) Trained individuals were more likely to give chest compressions and chest for DRACB. Untrained individuals more likely to cover/make someone comfortable.	Higher willingness to give MTM and call EMS for a family member compared to a stranger. However, less likely to leave to get help for a family member. Willingness to do chest compressions was lower for women.

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Swor et al. (2006)	US	CPR	Telephone interview (of calls to 911 during OHCA)- 684 respondents	N/A	54% trained		Predictors of CPR performance: witnessed arrest, occurring in public location, trained bystander or bystander had more than high-school education. For CPR trained bystanders, CPR training within five years was also a predictor.
Urban et al. (2013)	US	CPR	Survey of 532 respondents	Female 53% Mean age: 44 (±16)	42% trained	~50% did not feel confident in ability to perform CPR. 78% would be willing to perform Hands-Only CPR on a stranger.	A history of cardiac related events in the family and previous CPR training were associated with likelihood to perform Hands-only CPR.

Appendix C: Barriers/Enablers to Learning First Aid: Summary Table

Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers (decrease intention to learn)	Enablers (increase intention to learn)
Cheung et al. (2003)	Hong Kong	Cross-sectional survey of 357 participants.	Female (59%), Age: <45 (71%)	12% (19%, 53%)	Most common: lack of time, followed by: unknown where to obtain training, uninterested, CPR as unimportant, CPR training inaccessible or CPR too expensive.	
Chu et al. (2003)	Australia	Survey on CPR ability, barriers/facilitators for those presenting to hospital with or without chest pain or IHD and their household. Sample size: 558 respondents	N/A	~40% (22%; up to 57%)	Lack of: Information on CPR classes (35%), perceived intellectual (18%) and/ or physical (18%) capability to learn CPR. Concerned learning CPR would cause anxiety in person at risk of CA (17%).	
Donohoe et al. (2006)	UK	Interviews conducted on 1011 respondents	Female (52%) Age: <45 (57%), 45+ (43%) Employed (56%), retired/homemaker/carer (27%)		Limited Opportunities CPR not seen as a priority (i.e. too busy to take training) Physical inability (particularly in older respondents) Cost as barrier for younger respondents.	Providing incentive- e.g. free training, vouchers or discounts.

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers (decrease intention to learn)	Enablers (increase intention to learn)
Jennings et al. (2009)	Ireland	Cross-sectional survey of 974 respondents	Female (51%) Age: <45 (58%), 45+ (42%) (Note: 8% health care professionals and a further 4% in non-healthcare uniformed positions, e.g. police)	28% trained (N/A, 77%)	Lack of awareness of why CPR important (53%) Not physically able, afraid of being sued or getting infection and do not want the responsibility (33%). Cost was mentioned very rarely.	Workplace training as source of advertisement for/provision of training.
Keim et al. (2001)	US	Postal Survey of 947 respondents	Female (53%) Mean age 69 (48-88) *Sampled older age group in gated community where CPR classes are organised frequently (3 times a month)*	48% trained 84% not currently certified.	Increasing age was associated with a lower desire to become certified in CPR.	Those previously certified in the past were more likely to want to be CPR-certified than those who didn't.
Platz et al. (2000)	US	Cross-sectional survey of 100 family members of cardiac patients	Female (71%) Age: <50 (32%), 50+ (68%)	49% (7%; N/A) Note: 5 % of these were professionals	25% of the untrained individuals reported a lack of time or information as a potential barrier to training.	
Potts & Lynch (2006)		Review CPR	N/A	N/A	*Lack of:* Locations or opportunity (including advertisement of classes) and/or time. *Fear of:* causing more harm to person when using CPR, taking responsibility in real emergency (with belief that: if not trained, no responsibility to act), own ability to learn (intellectually and physically) CPR and/or infection (from manikins). *Belief*: CPR not seen as important Older adults (>50) felt physical ability to be a barrier.	

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Appendix C: Barriers/Enablers to Learning First Aid: Summary Table

Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers (decrease intention to learn)	Enablers (increase intention to learn)
Sasson et al (2013)	US	Focus groups with three target high risk neighbourhoods (i.e. high in OHCA and low bystander CPR)	Female (85%(<30 years (82%) Full/part-time work (45%, retried (10%), housewife (13%)	68% (7%; up to 43%)	*Financial*: Course, childcare and transportation costs was biggest issue in this sample *Informational:* lack of: understanding of CA and how CPR saves lives; class advertisement; access to technology and/or resources for non-English speakers *Motivational:* Personal health concerns, financial disincentive to learn, not required skill. *Fear of training:* Belief that by being trained, you are obligated to help and would "get into trouble/arrested" if do not help.	*Family/Self-preservation:* ability to save your own/family) by learning. *Economic incentives:* Gifts for participating, certification and job skill, no fees and academic credit.
Schmid et al. (2016)	Costa Rica	Survey of 370 respondents	Female (40%) >40 years (77%)	36% trained	Not Discussed	Future training was associated with prior training and having witnessed a cardiac arrest previously.
Vaillencourt et al. (2013)	Canada	Survey Study on over 55's, where equally sampled from urban and rural locations Sample size: 412 responses	Mean age: 66 Female: 59% Employed: 37%	58% (N/A; 59%)	Not Discussed	Belief that CPR could save a life Advertisements of classes
Vaillancourt et al. (2008)	N/A	Systematic review on understanding and improving low bystander CPR rates. (252 papers in final review)	N/A	N/A	Lack of time/interest, inconvenience of attending training, inability to find course, bad health/physical limitations, fear of contracting disease, and fear of being sued. These were particularly seen in older age groups.	

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Appendix D: Barriers/Enablers to Helping: Summary Table

Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
(Axelsson (2001)	N/A	Literature review	N/A	N/A	Feeling exposed Unpleasant feelings and thoughts concerning the situations, including sense of feeling deterred and powerless in their attempts to reverse death. Repugnance with physically seeing dying victim, particularly MTM. Issues included vomit, alcohol on one's breath or bleeding. Fear of infectious diseases: A discrepancy here between the potential rescuers' beliefs about disease transmission and reality. Uncertainty of one's performance and fear of making things worse.	Teaching people that one can never make the situation worse and that without help the victim will probably die.
Axelsson et al. (2000a)	Sweden	Qualitative interview on bystander perceptions of performing CPR (19 respondents) (In 26% of cases victim survived)	Female (58%) Age: 43 (22-64) Layperson (58%)		Feeling exposed or deserted (when alone in such a situation) A sense of powerlessness and a sense of ambivalence (will what I do save the person, will they be able to function normally) Uncertainty in one's performance of CPR and fear of making things worse Feeling repugnance with physically seeing death and dying victim, including physical symptoms (e.g. vomit) Fear of disease was not identified as a factor in this study.	Knowledge/belief: A sense of humanity (including a wish to save a life and natural instinct to help). Feeling obligation/responsibility to help and do one's duty (if it is one's profession) and/or with prior CPR knowledge activating a feeling of personal responsibility. Having competence (skills) and feeling prepared (physical and emotional). Training more (either more times or more recently) felt to help improve this. Having courage: needed to overcome uncertainty and fear, including seeing a dying victim. Inclusion of teaching on preparation of the rescuer for the real situation and discussing his/her reactions could increase willingness to help.

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
Bouland et al. (2017)	US	Survey of laypersons attending CPR training. Survey before and after training: 238 respondents.	Mean age: 47.5 (14-81) Female: 57%	63% (6.9%; 52.2%)	Fear of being sued: 4/10 median. Risk of disease: 5/10 Fear of hurting someone by doing CPR (when unnecessary (5.0)) Fear of hurting someone by doing CPR incorrectly (5.0) Those with previous training were less likely to report this effects as were those who had previous seen a sudden cardiac arrest.	
Chen et al. (2017)	China	Questionnaire survey in China of 1841 laypersons	Female (50.8%)	25.6% trained (N/A)	53% of respondents worried about legal issues.	If laws were implemented to protect bystanders who give aid, it reduced those not willing to perform CPR from 23.7% to 2.4%. Women were more worried about inadequate knowledge (then legal issues). For men, this was reversed (e.g. legal issues biggest issue).
Cheskes et al. (2016)	Canada	Survey looking at CPR (chest only vs. traditional) for 10 scenarios. Sample size: 428 respondents	Female (50%)	N/A	For an unkempt individual, initiating traditional CPR was lower and around 40% fear MTM for risk of infection. For stranger, this was lower at 23.6%. Fears of litigation and lack of skills competence were also reported more often in cases of strangers or unkempt individuals.	Knowledge/Beliefs: Feeling a sense of duty/responsibility. For all victim types (e.g. whether known, stranger, unkempt, etc.), willingness to perform CPR was higher for chest-only compression for CPR.
Chu et al. (2003)	Australia	Survey on CPR ability, barriers/facilitators for those presenting to hospital with or without chest pain or IHD and their household. Sample size: 558 respondents	N/A	~40% (22%; up to 57%)	Victim is unknown, unappealing physical victim characteristics (e.g. vomit, blood, dentures), fear of infection, fear of causing harm from improper CPR, fear of taking responsibility in an emergency. Note: 77% of their sample believed performing MTM could transmit infection.	

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
Donohoe (2006)	UK	Interviewers Sample Size: 1011	Female (52%) Age: <45 (57%), 45+ (43%) Employed (56%), retired/homemaker/carer (27%)	N/A	Those less recently trained, reluctance related to fear of doing more harm than good, a potential of being sued if performed CPR incorrectly. Fear of contracting disease. Regardless of training level, some people felt panic would influence their readiness to act.	Trained less reluctant and concerned about getting things wrong.
Hansen et al (2017)	Denmark	Qualitative interviews of real bystanders trained in CPR. Sample size: 128 interviews (16 analysed)	Mean (range) age: 53.5 (39-70) Sample could include some from security services or police.	All CPR trained	Uncomfortable and shocking (panicked). Sense of powerlessness and repugnance over patient's appearance was a big issue in preventing initiation of CPR.	Knowledge/belief: 1) intervention is crucial to survival, 2) cannot cause substantial harm (i.e. doing something is better than doing nothing). 3) feeling moral obligation to act. Teamwork (i.e. support). Having access to a ventilation mask can be helpful when there are physical barriers (e.g. blood, vomit, froth).

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
Jacobs et al. 2016	US	National survey of public on bleeding control Sample size:1051 respondents (of which 941 were deemed physically able to provide first aid)	N/A	47% (N/A, 52%)	Biggest barrier: For shooting incident scenario, it was presence of blood. For car crash scenario, it was a fear of causing additional harm. Generally: 71% had a fear of potential danger in emergency situation (e.g. in physical danger from additional violence), 65% had a fear of causing victim additional pain or injury, 61% concerned about bearing responsibility for a bad outcome, 61% were concerned with contamination with disease, 41% fearful of personal safety and 30% worried about the sight of blood. *Demographic factors did influence the levels of these barriers:* Non-white individuals were more likely to cite fear of causing additional pain or injury as a concern (54% compared to 26% of white individuals). Further, women (compared to men) were more concerned with causing injury (73% vs. 57%) and concerned with personal safety (50% vs 36%).	Introducing bleeding kits in public places.
Jacobs et al. (2017)	US	Surgeon's discussion and evaluation of public's knowledge about bleeding control and assessing training needs Sample size: 341 surgeons			Suggested need for classes in first aid to address public's fears of infection from blood and fear of doing harm.	

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(Johnston et al. (2003)	Australian	Survey study Sample size: 4480			Most common barriers: Fear of disease, visible blood, person looking dirty. Less common barriers: possible danger, vomit present, lack of confidence in skills/have no skills, alcohol present, victim a drug user, fear of legal consequences, thought someone else would help, person is a stranger or person is too old.	Common enablers: victim known to the individual, has knowledge that person would die without help, has confidence in one's skills and person is young/child. Less common enablers: no other bystanders, person looks cleans, availability of protective mouth gear and victim is elderly.
Mathiesen et al. (2017)	Norway	Qualitative interviews with real bystander, where CPR was successful	Female (40%) Age: <40 (40%) Sample size: 10 respondents	80% (25%; 75%)	Comprehension and Coping: difficulty understanding situation and disparity between real situation and training simulation, feeling of helplessness and fear of hurting the victim. Need to feel safe: hesitating in unclear/unfamiliar settings.	Knowledge/belief: Wanting to save a life and see CPR as natural thing to do. Seeing helping as doing what is right, being a community citizen. Having competence: having CPR knowledge and skills, or using dispatcher to retrieve competence, utilising knowledge learnt through the media. Confidence through teamwork: CPR assisted by other bystanders or dispatcher reduced feelings of being alone. Need to feel safe: Expectation of no legal consequences.
Moller et al. (2014)	Denmark	Survey (on debriefing real cardiac arrest witnesses) Bystander role: Caller (36%) Performed CPR (27%) Both caller and CPR performer (30%) Used AED (6%)	Female (48%)	67% (N/A)	Disparity between training and real bystander situation, including seeing: fear/patient in patients.	Debriefing help give helpers a sense of confidence in their skills (by giving them chance to clarify uncertainties) and give helper sense of relief (i.e. knowing they could not have done any more).

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Ozbilgin et al. (2015)	Turkey	Questionnaire survey of 533 participants.	Female (40%), Age (Mean: 37, Standard deviation, 12.12).	40.7% (N/A)	Concerned about making a mistake (77.2%), stopping a working heart (19.3%), causing harm to organs (11.8%), causing bone fractures (4.5%), punishment because of legal reasons (6.3%), contracting a contagious disease (8.2%) and contamination by blood or vomit (3.3%).	
Penrose (2009)	UK	National survey on CPR, recovery position and bleeding control skills conducted, and results summarised by British Red Cross Sample size: Unknown	N/A	68%	48% of respondents worried about getting first aid wrong. 24% had an issue with blood, 30% worried about being sued. 57% would be less likely to help if person look homeless, drunk or on drugs.	
Platz et al. (2000)	US	Cross-sectional survey of 100 family members of cardiac patients	Female (71%) Age: <50 (32%), 50+ (68%) Ethnicity: White (88%)	49% (7%; N/A)	Fear of harming the patient (49%), lack of knowledge/skill to help (35%), fear that CPR may not be needed in that situation (34%). Less common: Fear of disease (9%) and too emotionally upsetting (13%).	Trained individuals less likely to agree that fear of doing harm and not knowing what to do would inhibit performing.
Potts & Lynch (2006)		Review CPR (Confirm)	N/A	N/A	Fear of doing something wrong (combined with assumption that someone else more competent should help). Those less willing to help focussed on negative aspects of performing CPR: Stress of situation, bad outcome, infection from victim, contact with bodily fluids.	Those positive about helping: focussed on change to save a life and feeling of efficacy from knowing what to do.

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
Rasmus & Czekajlo (2000)	Poland	National survey Sample size: 1092 respondents	Female: 52% Age: <40 (48%), 40+ (52%) Employed (48%), students (9%), housewife/retired (32%) unemployed (9.2%)	N/A	Lack of ability to provide life-saving techniques	
Sasson et al. (2013)	US	Focus groups: 49% of respondents were in high risk neighbourhoods (high out of hospital cardiac arrests but low bystander CPR)	Female (85%)	68% (7%; up to 43%	Fear of legal consequences: Fear of lawsuit, misunderstanding Good Samaritan laws. Issues with age of victim (e.g. an adult performing mouth to mouth on a child). Questioning whether others in the community would stop to help. Knowledge: unsure how and when to perform CPR and confusion surrounding frequently changing guidelines. A fear of doing CPR incorrectly. Risk to personal health: providing MTM to a stranger and/or an unsafe setting.	
Schmid et al. (2016)	Costa Rica	Survey of 370 respondents	Female (40%), >40 years (77%).	36% (N/A)	Fear of performing MTM, believing CPR is against god's will, fear of legal risks if victim dies, belief CPR does not work and hesitancy to do mouth-to-mouth associated with performing CPR on a stranger. Aversion to helping poor individuals was associated with hesitancy to perform MTM and fear of legal consequences.	

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Authors	Location	Study Design & Sample Size	Relevant Demographics (if reported)	Ever Trained % (of these: <12 months; >5 years)	Barriers	Enablers
Vaillancourt et al. (2008)		Systematic review on understanding and improving low bystander CPR rates. (252 papers in final review)	N/A	N/A	Presence of vomit, dentures blood, body odour and alcohol smell. Ambiguity or uncertainty on what to do in a real situation reduces helping. More bystanders - less helping	CPR training associated with great confidence and therefore more helping (but does not mean an assurance of action)

[i] Knowledge and skills considered first-aid may therefore include: basic life support skills, Initial responsiveness checks, the recovery position, bleeding control and CPR.

[ii] We acknowledge that there is no singular public and that we would expect variation within as well as between population groups. However, for this review we are adopting a broad definition of 'the public' which includes anyone who is not a health professional.

[iii] A decision was made to stop at 100 items for both reasons of time constraints and a significant reduction in relevant sources at this point.

[iv] This date was set because changing regulations on what and how to train meant that first-aid training and the studies conducted on it before 2000 may not be relevant.